

## II. SOME UNDESCRIBED TADPOLES FROM THE HILLS OF SOUTHERN INDIA.

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(Plate I.)

With one exception the tadpoles here described were found in the hills of Cochin, in most cases with young frogs of their species, by Dr. F. H. Gravely and Mr. B. Sundara Raj in September, 1914. The tadpole of *Nyctibatrachus pygmaeus* was, however, obtained by Capt. R. B. S. Sewell, I.M.S., in a small lake in the Nilgiris. The species from Cochin are particularly interesting as illustrating peculiar adaptations in tadpoles that live in hill-streams.

### ***Rana verrucosa*, Günther.**

(Plate I, figs. 1, 1a.)

Boulenger, *Faun. Brit. Ind., Rept.*, p. 448 (1890).

The tadpole is small, by no means stout; the head and body are rather narrowly ovoid and somewhat depressed; the snout is bluntly pointed and declivous; the nostrils as seen from above appear to be nearer the tip of the snout than to the eyes; the distance between them is about half that between the eyes, which are situated on the dorsal surface but directed outwards and are evidently prominent in life. The spiracle is situated a little below the eye, nearer to it than to the posterior end of the body; it is tubular in form and points backwards and a little upwards. The ventral surface is convex.

The mouth-disk is very small and of the normal type, directed downwards and a little forwards, distinctly transverse in form, with a lateral emargination on either side; the anterior margin of the upper lip is fringed with teeth and devoid of papillae; the lateral margins are fringed with papillae, which become rather longer at the sides of the posterior margin; the middle part of this margin is smooth. The dental formula is  $1 : 1 + 1/3$ . The upper beak is crescentic and slender; the lower beak broadly V-shaped. The margins of both parts are very minutely serrated; the basal half of the lower beak is colourless.

The tail is relatively short and slender, tapering gradually, sharply pointed, with the fin-membranes relatively broad and the upper one commencing on the posterior part of the body. The anus is directed to the right.

The dorsal surface of the body is blackish, indistinctly mottled and marbled with white; on the snout and sides the colourless markings are of greater extent and more conspicuous; a dark spot occurs over each nostril; the ventral surface is colourless and transparent; the tail is whitish with conspicuous dark brown spots and irregular markings.

*Measurements of a specimen with the hind legs well-developed :—*

	mm.
Total length . . . . .	27.5
Length of head and body . . . . .	11
Breadth of head and body . . . . .	7
Depth of body . . . . .	5
Greatest depth of tail . . . . .	4

Specimens of this tadpole were found in an isolated pool in a rock beside a stream in the Cochin forests in September, 1914. Although it occurs in hill-country, the species probably does not breed as a rule in streams, for the larva is normal and not of any of the types commonly associated with life in running water.

In general appearance and structure the tadpole resembles that of *Rana limnocharis*, but it is stouter and has a relatively shorter tail.

*Distribution.*—Jungles of the southern part of the Malabar zone.

## SPECIMENS OF LARVAE IN THE COLLECTION OF THE INDIAN MUSEUM :—

17659-60. Parambikulam, 1700-3200 ft., Cochin State (*F. H. Gravely*).

***Rana beddomei* (Günther)**

(Plate I, figs. 4, 4a, 4b.)

*Boulenger, op. cit.*, p. 453.

The tadpole is small and very slender; the branchial region is prominent on either side; the head and body are narrowly oval; the snout is pointed and declivous; the eyes are situated on the dorsal surface and directed upwards; they are very large and prominent; the nostril, which is small and inconspicuous, is nearer to the eye than to the tip of the snout. The spiracle, which is not at all tubular but small and slit-like, is situated on the lower part of the left side of the body and is directed outwards and a little backwards; it is rather nearer to the eye than to the posterior edge of the body. On the dorsal surface a narrow groove extends inwards in a slanting direction from near the middle of each eye to meet its fellow on the opposite side; the combined groove extends backwards from a line joining the posterior third of the eyes as far as the base of the dorsal fin.

The mouth-disk is broadly triangular, entirely ventral in position; the upper lip, which is devoid of tubercles, is very distinct from the lower; it is narrowly but deeply notched in the middle line; the lower lip has a marginal fringe of minute tubercles. The dental formula is 1+1 : 1 : 2+2/2+2 : 2; the outermost row of teeth on the upper lip is situated on its margin; the beak is narrow and prominent, strongly hooked like that of a parrot; both the upper and the lower beaks are entirely black and have smooth edges.

The tail is extremely long and slender, and has, even in the young tadpole, the fin-membranes very poorly developed; the muscular part tapers gradually to a fine point; the dorsal membrane consists of a low ridge very inconspicuous on the anterior half of the tail; the ventral membrane is slightly better developed but also vestigial. The anus

is dextral, but not very strongly so; it does not form a prominent tubercle or tube.

The dorsal surface of the head and body is of a dark purplish-brown, minutely speckled with white and somewhat marbled on the snout. The lateral surface of the tail is also purplish-brown marbled with white; the whole of the ventral surface is colourless.

The hind limbs appear at an early stage of development and attain a large size and well-developed condition long before the appearance of the fore limbs.

The following are measurements of (A) of a specimen in which the hind limbs appear as small but elongated buds, and (B) of one in which they are fully developed.

	A.	B.
	mm.	mm.
Total length . . . . .	14.5	34
Length of head and body . . . . .	3	11
Breadth of head and body . . . . .	2.5	7
Depth of body . . . . .	2	4
Greatest depth of tail . . . . .	1.5	1.5

A large series of this remarkable tadpole and of young frogs was taken by Dr. F. H. Gravely at the edge of a rocky stream on the Cochin hills in September, 1914. He describes the larger individuals (in which the fore limbs had not appeared) as skipping rapidly over damp rocks when disturbed. It is very curious that a frog so closely allied to *R. leptodactyla* and *R. semipalmata* should possess a larva so different, but it is clear that the tadpoles of all these forms are very highly modified.

SPECIMENS OF LARVAE IN THE COLLECTION OF THE INDIAN MUSEUM :—

17671. Parambikulam, 1700-3200 ft., Cochin State (*F. H. Gravely*).

***Rana leptodactyla*, Boulenger.**

(Plate I, figs. 2, 2a, 2b.)

Boulenger, *op. cit.*, p. 454.

The tadpole is moderately small; the head and body are moderately stout, oval; the snout is narrowly rounded in front, somewhat constricted laterally, declivous; the eyes are situated far forward, directed forwards and outwards, lateral rather than dorsal, probably very prominent in life; nostrils about half way between eye and tip of snout, further apart than their distance from the eyes; the interorbital breadth nearly twice the internasal; a row of minute white glands runs round the outer and upper margins of the orbit, passing along above the nostril on each side to meet its fellow in the middle line a short distance from the tip of the snout. The spiracle is small, sinistral, situated nearer the dorsal surface than the ventral and nearer the eye than the base of the hind limb. The ventral surface is strongly convex.

The mouth-disk is small, directed downwards and a little forwards, without horny teeth; the upper lip is very distinct, forming a crescentic membrane which can be closed down over the mouth, fringed with short, pointed papillae and bearing two or three rows of similar papillae at its

base just above the upper beak ; the lower lip is divided into five lobes, of which two are lateral in position and much larger than the other three, which occupy the posterior margin of the disk ; the upper one-third of these lateral lobes, each of which is half as broad as the upper lip, is capable of being folded backwards ; the three posterior lobes of the lower lip are sub-equal, pointed below and edged with short processes ; similar processes are scattered on the base of the three lobes near the lower beak ; both parts of the beak are slender, the upper beak relatively broader than the lower, which is a little stouter and V-shaped ; both parts are minutely serrated and the upper is entirely black ; the basal part of the lower beak is white.

The tail is powerful, tapering gradually to a rather blunt point ; both membranes and muscular part are well-developed, the latter about twice as deep as either membrane at its base, both membranes reaching the posterior extremity of the body.

The dorsal surface of the head and body are yellow, with boldly contrasting black marks, which extend on to the lateral surfaces ; the ventral surface is shaded with black, the pigment being distributed in minute, short hair-like lines ; the colour of the tail is similar to that of the dorsal surface of the head and body.

*Measurements of a specimen in which the hind limbs are just making their appearance :—*

	mm.
Total length . . . . .	31
Length of head and body . . . . .	12.5
Breadth of head and body . . . . .	7.5
Depth of body . . . . .	6
Greatest depth of tail . . . . .	5

I have examined only two specimens of this tadpole. Although they are accompanied by young frogs of the species, as well as by those of *R. semipalmata* and *R. verrucosa*, the series is by no means complete and I rely for the identification rather on circumstantial evidence and on the resemblance between the specimens and those of the larva of *R. semipalmata* than on any more definite grounds.

The specimens were obtained in a small pool at the edge of a jungle-stream in the hills in September. Unfortunately no information is available that would cast light on the peculiar structure of the mouth-parts in this and the next species.

*Distribution.*—Hills of the southern part of the Malabar zone and the neighbouring districts.

SPECIMENS OF LARVAE IN THE COLLECTION OF THE INDIAN MUSEUM :—

17698. Kavalai, 1300-3000 ft., Cochin State (*F. H. Gravely*).

***Rana semipalmata*, Boulenger.**

(Plate I, figs. 3, 3a, 3b.)

Boulenger, *op. cit.*, p. 454.

This tadpole closely resembles that of *R. leptodactyla*, from which it differs in the following particulars :—

1. The whole animal is slighter and smaller.

2. The tail is a little longer in proportion to the head and body, its length being more than five times its greatest depth.
3. The upper lip is relatively much broader, being more than three times the breadth of one of the lateral lobes of the lower lip.
4. The beak is relatively broader and stouter.
5. The markings are less conspicuous and the ventral surface is colourless.

Mr. Gravely obtained a complete series of this larva, with many young frogs, in the same circumstances as those in which he found the tadpoles of *R. leptodactyla* and *R. verrucosa*.

SPECIMENS OF LARVAE IN THE COLLECTION OF THE INDIAN MUSEUM :—

17702. Parambikulam, 1700-3200 ft., Cochin State (*F. H. Gravely*).

***Nyctibatrachus pygmaeus* (Günther).**

(Plate I, figs. 5, 5a.)

*Boulenger, op. cit., p. 467.*

The tadpoles are of moderately large size ; the head and body rather narrowly oval, flattened moderately, the ventral surface being distinctly convex ; the snout is rounded, the nostrils rather widely separated, nearer to one another and to the eyes than to the tip of the snout, the distance between them being much more than half the interorbital breadth ; the eyes are dorsal but directed outwards, situated at about one-third the distance between the tip of the snout and the base of the hind limbs. The spiracle is lateral, sinistral, somewhat tubular, pointing upwards and backwards.

The mouth-disk is large and somewhat sucker-like, entirely ventral, but with opposible lips and a lateral emargination on either side. The lower lip is edged with minute finger-like processes, the lateral region of the disk, which is produced in two lobules, is densely covered with similar processes ; the upper beak is shallow, broadly U-shaped, entirely black, with smooth or almost smooth margins, the lower beak much narrower, V-shaped, distinctly but minutely serrated on the margins, white at the base for at least half its depth. The dental formula is  $2 : 5 + 5 / 1 + 1 : 5$ , the three upper tooth-rows being equal and the interruption in the third being very slight ; the five upper tooth-rows of the lower lip are equal and the sixth rather shorter ; the interruption in the first row of this lip is very slight.

The tail is long and slender, narrowly lanceolate, the muscular part relatively deep in the middle, the whole tapering to a fine point ; both membranes arise a considerable distance behind the base of the hind limbs.

The dorsal and lateral surfaces of the head and body are purplish-brown with a few dark spots, becoming paler between the eyes, the ventral surface yellowish, the proximal third of the tail brown with a few dark spots, the distal two-thirds as a rule more deeply pigmented, marbled with purplish-brown and buff or almost entirely of the former colour, the membranes bearing scattered pigment-cells.

*Measurements of a specimen with the hind limbs fairly well developed :—*

	mm.
Total length . . . . .	51
Length of head and body . . . . .	19
Breadth of head and body . . . . .	10
Depth of body . . . . .	7
Greatest depth of tail . . . . .	6

The specimens in the Indian Museum were collected in a small lake in June, 1912. They include a young frog with the tail still unabsorbed.

*Distribution.*—Anamalai and Nilgiri Hills, South India.

## SPECIMENS OF LARVAE IN THE COLLECTION OF THE INDIAN MUSEUM :—

17248. Coonoor, Nilgiri district, Madras (*Capt. R. B. S. Sewell, I.M.S.*)

**Species Incertae Sedis.**

(Plate I, figs. 6, 6a.)

Annandale and Narayan Rao, *Proc. As. Soc. Bengal* (n. s.) XIII, p. clxxxvi (1917).

The tadpole is large; the head and body massive but flattened, broadly rounded in front, relatively very large; the eyes and nostrils are situated far back, the latter about half way between the hind limbs and the tip of the snout; the distance between the nostrils is much less than that between them and the eyes, about half the inter-orbital breadth; the eyes are small, entirely dorsal; the distance from the tip of the snout to the nostrils is more than twice that from nostril to eye.

The ventral surface is flattened. The spiracle is sinistral, laterally tubular, pointing upwards and backwards, situated rather nearer the anus than to the tip of the snout.

The mouth-disk is ventral, transversely oval, sucker-like, surrounded entirely by a margin covered with small rounded tubercles, occupying (when the mouth is open) about one-third of the ventral surface; the upper and lower lips are not opposible; the dental formula is  $2/3$  or  $2/1+1:2$ ; the two upper tooth-rows are equal and a little longer than the three lower rows, which are also equal; the upper and lower beaks are each in a single piece, rather shallow (especially the lower beak), moderately stout, with their margins very minutely serrated; they are white with black margin.

The tail is relatively short and feeble, shallow, sharply pointed; the fin-membranes moderate both above and below, each of about the same depth as the muscular portion in the middle of the tail, the upper membrane commencing some little distance behind the base of the hind legs.

The colour of the dorsal and lateral surfaces is dark grey with small black spots, the tail is marbled with dirty white; the ventral surface is colourless except for a few scattered pigment-cells.

The anus opens by a transverse slit, which extends right across the base of the tail on to a little flattened leaf-shaped membrane, which extends backwards on the ventral surface and is situated to the right of the middle line.

*Measurements of a specimen which has the hind limbs fairly well-developed :—*

	mm.
Total length . . . . .	62
Length of head and body . . . . .	24
Breadth of head and body . . . . .	15
Depth of body . . . . .	9
Greatest depth of tail . . . . .	8

The inner metatarsal tubercle on the feet makes its appearance at an early stage and is spade-like and very conspicuous, being almost white while the sole of the foot is black.

The pectoral girdle, which has been dissected out from a nearly adult tadpole by Mr. C. R. Narayan Rao, closely resembles that of *Leptodactylus*,<sup>1</sup> except that the sternum is poorly developed, and the frog possibly belongs to the Cystignathidae as we suggested in the paper cited. It is improbable that it belongs to any species of which the adult has been described, and new genus of the family as recorded from India. I thought at first that it was the larva of *Nyctibatrachus major*,<sup>2</sup> but have since received a series of tadpoles and young frogs of that species in hardly good enough condition for description. They are quite different. In some respects this tadpole bears a close resemblance to that of *Heleophryne natalensis*, a South African Cystignathid recently described by J. Hewitt.<sup>3</sup> It differs from those of *Bufo penangensis*<sup>4</sup> and *Bufo asper*<sup>5</sup>, both of which have greatly enlarged lips modified to form an organ of adhesion, in that both the lips are equally enlarged, instead of the lower lip being much the greater of the two. The tadpoles in the collection of the Indian Museum were collected in September, 1914; they were found clinging to rocks by means of their oral suckers in rapid-running streams in the neighbourhood of waterfalls. The larvae of *H. natalensis* were observed in similar situations in the valley of the Krantz Kloff in October, 1912.

SPECIMENS OF LARVAE IN THE COLLECTION OF THE INDIAN MUSEUM :—

17709. Kavalai, 1,300-3,000 ft., Cochin State . . . . .	}	( <i>F. H. Gravely</i> ).
17719. Parambikulam, 1,700-3,200 ft., Cochin State . . . . .		
17720. Forest Tramway, mi. 10-14, 0-300 ft., Cochin . . . . .		

<sup>1</sup> See Boulenger, *Cat. Batr. Sal. Brit. Mus.* p. 238, fig. (1882).

<sup>2</sup> *My Rana travancorica* (*Rec. Ind. Mus.* V, p. 191 : 1910) is synonymous with *N. major*.

<sup>3</sup> *Ann. Natal Mus.* II, p. 478, pl. xxxix, figs. 5, 6, 7 (1913).

<sup>4</sup> Flower, *Proc. Zool. Soc., London*, 1899, p. 909, pl. lx, figs. 3, 3a.

<sup>5</sup> Van Kampen, *Nat. Tijds. Ned. Ind.* LXIX, p. 30, pl. ii, fig. 2.